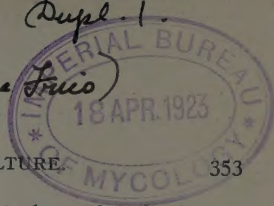


J. H. Cunningham
Puckria
Coral sp. (Cinnabarina Yoda Trico)



DEC. 26, 1922.

N.Z. JOURNAL OF AGRICULTURE

353

about the plant is the strong colour contrast shown by the leaves, which are bright green above, while the under-surface, owing to its being completely covered with a thin felt of hairs, is quite white, the red-purple midrib and veins standing out sharply against this background.

The flowers of Japanese wineberry are carried in bunches at the ends of the branches. The petals are very small, and are much less showy than the large lobes of the calyx (the outermost ring of floral leaves), which spread in the form of a star. The flower-stalks and the branches just below them are clothed, like the stems, with red-purple hairs, which are here so abundant as to form a kind of fur. The specific names of plants are generally inappropriate enough, but the name *phoenicolasius* (i.e., "purple wool") is very apt, describing what is certainly the most characteristic feature of the whole plant. It should be mentioned that the hairs are of the type known as glandular, each being tipped with a minute knob like a pin's head, which secretes a sticky substance.

The fruit of Japanese wineberry is of a bright clear red colour, rather like a small raspberry in size and shape, and, like it, pulling right away and leaving a hollow in the fruit when picked, while in flavour it is not unlike a mulberry.

HISTORY OF THE PLANT IN NEW ZEALAND, AND POSITION AS A WEED.

As its name implies, the subject of this article is a native of Japan, whence it was introduced into cultivation many years ago. It was much advertised under the name of "Japanese wonderberry" as being superior to all other types of raspberry for domestic use. The glowing accounts of its ease of cultivation and great yields induced a number of people in New Zealand to give it a trial, and many gardens are still to be found where the plant is in cultivation, though in spite of the pleasant flavour and abundance of the fruit it has never become really popular. The only locality where Japanese wineberry has spread to any appreciable extent is in the Cook and Waikohu Counties of Poverty Bay, where it has become established in isolated areas.

The fact alluded to—that the branches of Japanese wineberry do not, like those of blackberry, arch back to the ground and root at their tips—is an important one in considering the question of its control. It means that, unlike blackberry, the plant cannot grow again from pieces left in the soil, the difficulty of eradicating it being therefore comparatively slight. It should at least be possible, with but little expenditure of time and labour, to prevent the plant's invasion of fresh areas from those where it has become thoroughly established.

Board of Agriculture.—Mr. G. L. Marshall, of Marton, has been appointed a member of the Board of Agriculture, as representing the Farmers' Union.

National Forestry.—"Forestry aims at continuously productive State forest lands, and the propagation, growth, and exploitation of the ripe timber crops in perpetuity." It is only by the application of silviculture to the national forest lands that the ever-increasing needs of the country may be met. The public safety demands the extension of forest-management to all the Crown woodlands, and the control by one authority of these properties and all other public lands chiefly valuable for forestry.—*Annual Report of State Forest Service, 1921-22.*

CORAL-SPOT, *NECTRIA CINNABARINA* (TODE) FRIES.*

A WOUND-PARASITE OF FRUIT-TREES.

G. H. CUNNINGHAM, Biological Laboratory, Wellington.

CORAL-SPOT is a fungus widely distributed throughout the world, occurring as a parasite on the living branches of a large number of hosts, and as a saprophyte on dead branches, twigs, &c., remaining on the tree or lying on the ground or on the floor of plantations and in heaps of prunings. Among the many hosts attacked may be mentioned pip- and stone-fruit trees, small fruits, broom (*Sarothamnus*), elm (*Ulmus*), horse-chestnut (*Aesculus*), maple (*Acer*), mulberry (*Morus*), oak (*Quercus*), and silver-birch (*Betula*).

It was long believed that coral-spot was parasitic on currant-canes, as the fructifications of the fungus invariably appeared following wilt and death of the canes. Recent work by Grossenbacher and Duggar (1911) has shown that in this case coral-spot is merely a saprophyte, death of the canes being due to another fungus, *Botryosphaeria Ribis* G. et D.

ECONOMIC IMPORTANCE.

Coral-spot attacks only the woody parts of a tree, and in consequence is not readily noticed by the orchardist, whose chief concern is the marketing of blemish-free fruit. Nevertheless, by the destruction of fruiting-branches, and consequent reduction of output, it has proved serious enough to warrant more notice being taken of its presence. Its effects in an orchard in any one season are generally slight, but under certain conditions it may cause considerable loss by killing large branches, or even entire trees. Such a period occurred in Central Otago during the winter of 1919, when many hundreds of trees, particularly apricots, were killed outright.

APPEARANCE AND EFFECT ON THE HOSTS.

This disease is a wound-parasite, and through an injured surface may infect branches, stems, and laterals, and occasionally roots. Its effects on the host vary according to the position of the point of infection and the severity of attack. If, for example, a single branch is infected it may be killed outright in one season, death being preceded by sudden wilt of the foliage, and shrivelling of any fruit that is present; sometimes, however, an infected branch may live for several seasons, in which case it makes little growth, the leaves being smaller than normal and somewhat yellowish. Although fruit may set on diseased branches it seldom reaches maturity.

Should the stem become infected the tree as a rule is killed outright in the one season. Here infection is followed by sudden wilt of the leaves, and shrivelling of the fruit. These do not fall, but

* Synonyms: *Creonectria purpurea* (L.) Seaver; *Sphaeria cinnabarina* Tode; *Tubercularia vulgaris* Tode; apricot gummosis.

remain attached to the branches until some little time after their death. In such an instance death is invariably preceded by copious gumming.

Death of the branch or tree may be preceded or followed by the appearance of small sunken cankers, but generally the only indication of the presence of the organism is the dying of the branch, followed by a slight shrivelling of the bark. Shortly after the affected portion has been killed small bright-pink pustules appear bursting through the dead bark (Fig. 1). The presence of these pustules, preceded by wilting of the foliage, may be taken as some indication that the damage has been caused by coral-spot; but it is quite possible that the fungus may be present merely as a saprophyte, death of the branch being caused by some other disease, such as valsa-injury or silver-blight.

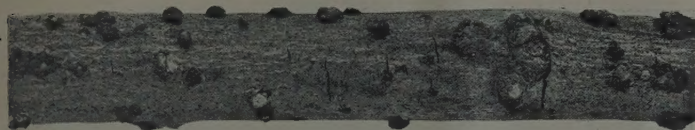


FIG. 1. DEAD APPLE-SHOOT WITH FRUCTIFICATIONS OF CORAL-SPOT.

The light-coloured spots are the pustules of conidia; the dark, perithecia. Natural size.

[Photo by W. D. Reid.]

LIFE-HISTORY OF THE CAUSATIVE ORGANISM.

Coral-spot is caused by *Nectria cinnabarina* (Tode) Fries., a fungus with two spore stages (conidia and ascospores) in its life-cycle. The conidial stage is produced shortly after the branch has been killed, but the ascigerous stage does not appear until some time after, usually during the winter months.

As it is so commonly found on dead wood, doubt has been expressed as to whether coral-spot is at any time parasitic, some plant pathologists claiming that its association with a cankered area or killed branch is not necessarily an indication that it has been the cause of death, but rather that in such cases it is merely associated with the causative organism, living saprophytically on the dead wood. Mayr (1882), however, has by a series of experiments proved beyond doubt that, given favourable opportunity, it can become a destructive wound-parasite. Spores (ascospores or conidia) produced from fructifications upon dead wood on adjacent trees, or from dead sticks, prunings, &c., lying on the ground, are carried by the wind or other agency to wounds on the branches of living trees. Here, should conditions prove favourable, they germinate and produce a germ-tube which penetrates the tissues of the exposed and dead wood of the wounded areas, where it grows vigorously, branching repeatedly to form a mycelium, the hyphæ of which spread rapidly to the water-conduction vessels of the sap-wood. These vessels are killed and soon completely filled with the mycelium; further upward passage of food solutes being thus prevented, sudden wilt of the portions above the point of entry follows. Apparently the fungus cannot attack living bark or cambium, these tissues dying in consequence of the destruction of the tissues of the sap-wood lying immediately beneath.

Where entry has been effected on a large branch it may be several seasons before the death of that branch occurs. In such a case a canker is formed which gradually enlarges year after year until the branch becomes girdled, when it dies. The conditions essential to the penetration of the host by the fungus are the presence of abundant moisture, and of dead tissues in the wounded area. Throughout this article the term "wound" has been used in the sense of an abrasion in the bark sufficiently deep to expose the sap-wood. It should be mentioned that entry may be effected through any dead area, such as dead laterals, or dead stubs left as the result of careless pruning; in fact, so long as dead tissue is present in any quantity on a tree there is danger of infection. It is recorded that in Europe coral-spot has been known to attack mulberry through buds injured by frost.

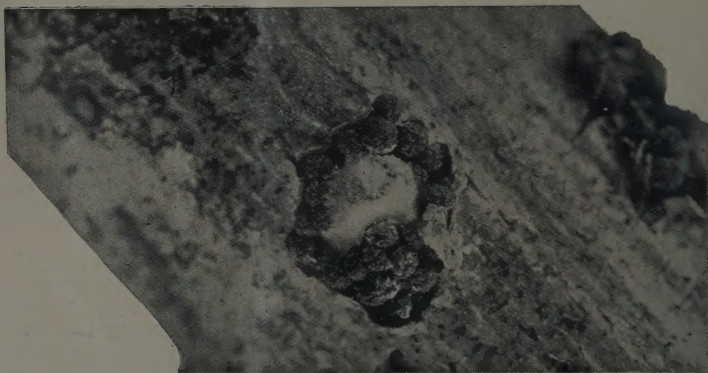


FIG. 2. FRUCTIFICATIONS OF CORAL-SPOT. $\times 20$.

Conidial pustule (light-coloured) surrounded by perithecia.

[Photo by W. D. Reid.

FIG. 3. SECTION THROUGH CONIDIAL PUSTULE. $\times 40$.

(*con*) Conidial layer; (*pa*) palisade layer; (*st*) stroma; (*e*) epidermis. Camera lucida drawing. Original.

FIG. 4. SECTION THROUGH STROMA BEARING PERITHECIA. $\times 40$.

(*p*) Perithecia; (*st*) stroma; (*e*) epidermis. Camera lucida drawing. Original.

FIG. 5. SECTION THROUGH PERITHECIUM. $\times 150$.

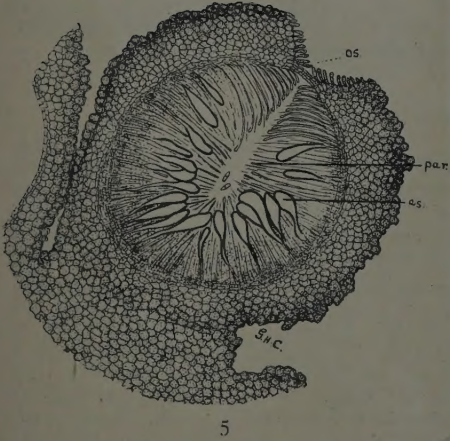
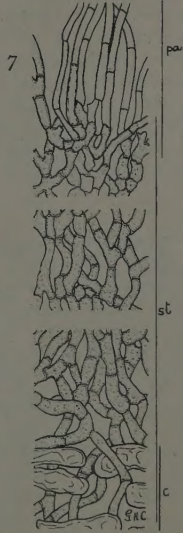
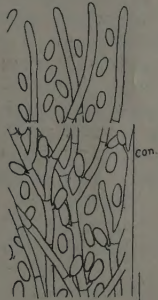
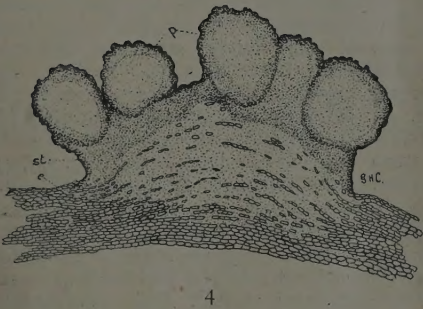
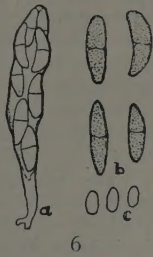
(*os*) Ostium; (*par*) paraphyses; (*as*) asci. Note how the asci are embedded in a mass of the hair-like paraphyses. Camera lucida drawing. Original.

FIG. 6. ASCI, ASCOPORES, AND CONIDIA.

(*a*) Ascus containing spores; (*b*) two-celled ascospores; (*c*) conidia. Camera lucida drawing. (*a*) $\times 380$; (*b*) (*c*) $\times 500$. Original.

FIG. 7. SECTION THROUGH CONIDIAL PUSTULE. $\times 500$.

(*st*) Stroma; (*pa*) palisade layer (shown in Fig. 3 as deeply shaded central portion); (*con*) conidiophores bearing conidia on short lateral branches; (*c*) plant-cells. (In order to enable this section to be shown sufficiently magnified, so that details may be observed, it has been necessary to omit certain portions; these are represented by gaps in the drawing.) Camera lucida drawing. Original.



Spores alighting on the surface of this dead tissue (whether dead wood, bark, or buds) germinate, and for a time the resultant mycelium lives saprophytically, gradually acquiring a quantity of reserve food, and spreading into the living tissues as described. Here it kills the cells by the secretion of certain toxic substances, utilizing the starch-grains stored within these cells, and in their stead depositing a greenish substance—probably some decomposition product—which stains the infected wood a dark colour that is clearly visible when a diseased branch is sectioned.

Upon the death of the limb or branch attacked the organism continues to live as a saprophyte, and from hyphæ situated near the periphery of the wood produces closely woven masses of mycelium, which burst through the now dead cortex and appear on the surface as bright-pink cushion-shaped pustules up to 2 mm. in diameter (Fig. 2). A typical pustule consists of a closely woven base of mycelium (stroma) from which upright hyphæ (conidiophores) arise (Fig. 3). Each conidiophore is branched, and on short lateral secondary branches minute colourless spores (conidia) are borne (Fig. 7). Later in the season, from the same stroma arises a cluster of small, dark-red, flask-shaped perithecia (Fig. 4). Each perithecium opens at its apex by a small pore (ostium) (Fig. 5, *os*), and contains numerous club-shaped asci, immixed with numerous hair-like paraphyses (Fig. 5, *par*). Each ascus contains eight one-septate colourless ascospores (Fig. 6).

The discharge of ascospores occurs only in the presence of abundant moisture, which causes certain portions of the tissues within the perithecium to become gelatinous. As a result the asci are subjected to pressure and the ascospores forced out into the perithecium, where they become embedded in the gelatinous matter. This continues to swell by the absorption of moisture, and there finally issues through the ostium a curled tendril, which is white and quite visible to the eye. In this gelatinous tendril the ascospores are embedded, and are freed as the matrix is dissolved away by the rain. The spores then lie on the surface of the stroma until dry, when they are dispersed by the wind. Should they alight on a suitable substratum they may germinate and produce a mycelium, which penetrates the tissues and in turn gives rise to pustules bearing conidia.

REMEDIAL TREATMENT.

From the foregoing it is seen that the organism spreads either from fructifications produced on branches which have been killed by it, or from dead sticks lying on the ground, upon which it may have been living saprophytically. Furthermore, it has been shown that the organism is a wound-parasite, and can attack a tree only through a wounded surface in which dead tissues are present.

Wounds may be due to the following causes: During picking and pruning operations abrasions are sometimes formed on the limbs, and often branches are split at their junction. Laterals may die as a result of the defoliation caused by attacks of leaf-rust or insects (*e.g.*, bronze beetle); or they may be killed by frost injury, as was abundantly evident in Central Otago in 1919. Cankers may be formed in shoots and branches by woolly aphis and other insect pests. Apricots commonly have large crevices in their stems, formed as the

result of gumming. All these injured areas afford excellent opportunity for the penetration of the spores of *Nectria*.

The following preventive treatment is recommended: During pruning operations remove all dead wood from the trees. Pick up and burn all prunings, and burn all old heaps of rubbish adjacent to the orchard, thus minimizing spore-production. Trim all rough edges of wounds; and cut off stubs of broken branches close to the main stem, so that they may readily callus over. Where a branch has been split at the crotch it should be bound up, or else cut out altogether. Deep and narrow crevices should be filled with grafting-wax or some such suitable matrix. Gum-pockets should be cut out. Finally, all exposed surfaces should, as soon as made, be coated with coal-tar, care being taken to prevent the tar from running on to the healthy bark. All wounds should be painted annually until such time as they callus over. This is a necessary precaution, as all large wounds have a tendency to crack and expose wood uncovered with any protective coating.

LITERATURE CONSULTED.

- CUNNINGHAM, G. H. 1920. Mortality among Stone-fruit Trees in Central Otago. *N.Z. Jour. Agr.*, Vol. 20, pp. 359-64.
- GROSSENBACHER, J. G., and DUGGAR, B. M. 1911. A Contribution to the Life-history, Parasitism, and Biology of *Botryosphaeria Ribis*. *New York Agr. Exp. Sta. Tech. Bull.* 18, pp. 113-90.
- HARTIG, R. 1894. *Text-book of the Diseases of Trees*, p. 96. London.
- MAYR, H. 1882. Ueber der Parasitismus von *Nectria cinnabarina*, *Untersuch. a. d. Forstb. Inst., zu Muenchen*, III, p. 1.
- SEAYER, F. J. 1909. The Hypocreales of North America, II, *Mycologia*, Vol. 1, p. 184.

SOME EXPERIMENTS IN AFFORESTATION ON THE WAIOTAPU-TAUPO PLAINS.

E. EARLE VAILE, "Broadlands," Waiotapu.

HAVING always been a lover of trees, one of my first operations after fixing the site of "Broadlands" homestead in June, 1907, was to procure from Auckland and plant out about a hundred *Pinus insignis*. These, transferred from so soft a climate, were severely frosted back, but all ultimately recovered and grew into good trees. The next year I bought *Pinus insignis* and *Cupressus Lawsoniana* in Dunedin. They stood the journey well, soon started a good growth, and were not affected by frost. However, the expense was too great for operations on a considerable scale. At that time I could not purchase a single tree locally, so it comes about that the great bulk of trees on "Broadlands" have been raised from seed on the place, and this is undoubtedly the best plan in most cases.

If the directions given in some recent publications of the State Forest Service are followed carefully there should be very few failures,

but planters must recognize that success cannot be achieved without taking trouble. More information is required, however, regarding vermin-control. A hare will run along a row of tree-seedlings, eating none, but nipping dozens off close to the ground. Rabbits will scratch very many out, and nibble others down. For this reason during several years I planted out no seedlings, but only two-year-olds. However, this plan proved very expensive, and I have now netted in 700 acres. The Forestry authorities might suggest some cheap and effective method of combating this great scourge of private planters; for instance, would spraying with certain mixtures protect the young trees? Of course, this is a question that hardly affects the State Forest Service itself. The latter utilizes great areas of virgin scrub where there are very few hares and rabbits, and little to attract them. Compare these conditions with those of a settler with paddocks which he wants to shelter with trees. His shelter-belts will be only a chain or two wide, and will be either between two paddocks or between his paddocks and the scrub. The vermin run across them continually from their shelter in the scrub to their feeding-grounds in the paddocks, or from one paddock to the other. So good-bye to seedling trees!

For two years I had great success with the drilling-in of eucalypts. The land was ploughed out of the scrub and prepared as for turnips. I tried *Eucalyptus viminalis*, *E. acervula* (*ovata*), *E. Macarthuri*, *E. Gunnii*, *E. obliqua*, *E. fastigata*, and *E. gigantea*, mixing the seed at the rate of $\frac{1}{2}$ lb. to the acre with manure at the rate of 75 lb. to the acre, sowing through the two outside coulter only, and leaving 9 ft. or 10 ft. between the wheel-marks on the return trip. A very large area is thus covered in a day. Of these varieties *viminalis*, *acervula* (*ovata*), and *Gunnii* proved an outstanding success, *Macarthuri* a qualified success, and the others a failure. They germinated fairly well, but the winter frosts finished them off. Their only chance would be under a semi-shelter. In the case of the three successful varieties I found $\frac{1}{2}$ lb. to the acre too heavy a seeding; $\frac{1}{4}$ lb. would be plenty. One most astonishing thing was that the vermin left these three varieties growing *in situ* from the seed absolutely alone. Had they been transplanted, undoubtedly the majority would have been destroyed. The same peculiar immunity applies to pines self-sown through the scrub. *E. Macarthuri*, drilled and treated in the same way in all respects, germinated not one-tenth the germination of the successful varieties, and the young plants were to an appreciable extent attacked by vermin. *Pinus insignis* treated similarly, only sown a little deeper in the soil, has been an absolute failure on all occasions.

Last spring my drilling of eucalypts and *Cupressus macrocarpa* was a fair success, but the two previous seasons were failures, due to rainless weather. Owing to the exceeding smallness of eucalypt-seeds they must be sown practically on the surface, and rain is necessary to germinate them and keep them growing for a while.

I have also had success with *E. viminalis* and *E. acervula* (*ovata*) sown by hand with a little manure on prepared ground, and harrowed in with a chain harrow—just the same as grass-seed.

It may be helpful to other beginners in this and similar areas if I tabulate the results of my experiments as follows:—